NASA Langley's Vehicle Reentry Safety Assessment

Using the boundary layer transition tool

NASA Langley has developed a software tool to predict the proper aeroheating environment to use in assessing potential damage to equipment and vehicles during atmospheric reentry. The software was developed to satisfy the recommendations of the Shuttle Return-to-Flight board after the Columbia accident. The technology offers the ability to predict how surface imperfections such as a raised component or indention will alter airflow across the boundary layer. The boundary layer transition tool can then determine the time at which the boundary layer will transition from laminar conditions to turbulent, with its associated higher heating, during reentry. Once the proper aeroheating environment is determined, then other structural response tools, such as thermal and stress tools, can be used to assess the health of the thermal protection system for reentry. Based on the results, Mission Control can better evaluate the situation and determine if repairs are needed prior to vehicle reentry.

Benefits

- Predictive – The software provides an accurate prediction of how damage will affect reentry conditions.
- Distinctive – The technology is a newly developed application to meet specific vehicle reentry needs.
- Customizable – The software database is customized based on specific vehicle properties and dimensions.

partnership opportunity

Applications

- Aerospace – safe vehicle reentry tool
- Telecommunications – end of satellite life reentry destruction tool

The Technology

After the Columbia accident in 2003, NASA determined that there was a distinct need to be able to analyze any damage that may occur during vehicle launch or in flight by debris and micrometeorites. This need is realized through the use of the boundary layer transition tool and other analysis tools and methodologies developed to detect, assess, and repair damage while the Space Shuttle is in flight.

This new technology analyzes the boundary layer properties surrounding the thermal protection system and provides a predictive model that can be used in assessing whether it is safe to perform vehicle reentry or whether in-flight repairs are needed. The boundary layer transition criteria were developed based on vehicle-specific wind tunnel testing. Once the database has been compiled for a specific vehicle, computer simulations and predictions are straightforward and repeatable. The necessary inputs include damage assessment, such as the location and size of a cavity, which can be determined based on, for example, photographic evidence.

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

The Technology Gateway

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